ABSTRACT

The city of Solo is one of the densest cities in Indonesia. From the Surakarta Central Bureau of Statistics, the population density of Solo City reaches 12,000 people per one square kilometer. This certainly affects the magnitude of the increasing demand for clean water resources and the reduction of rainwater catchment areas which can lead to disasters such as floods and landslides. So, we need a sustainable roof design innovation, especially in residences is simple to be easily applied. This simple house is designed with type 70/120 and contains 4 people. The sustainable roof component is an extensive green roof with 5.1 meters long, 2.3 meters wide, and 0.8 meters height using sedum grass, an application of rainwater harvesting with a capacity of 1960 liters that is used to fill the needs of clean water for residents, as well as electricity for a pump that uses powered solar Cell 100 wp.

Keywords : green roof, rainwater harvesting, solar cell

CHAPTER I

INTRODUCTION

A. Background

Earth as a place to live for the lives of various living things, has natural resources that can be used to support the life of these living things. Natural materials available on earth include plants, water, soil, rocks, minerals, coal, natural gas petroleum, sunlight and others. Each type of natural material has its own role for human life, both directly and indirectly. The natural materials around us have their own characteristics and characteristics that are different from each other. These characteristics include the physical properties, chemical properties and structure. These characteristics make these natural materials have their respective functions.

Increasingly diverse human needs and increasing population make increasing needs and the increasingly diverse needs of life. One of them is in the city of Solo. According to data taken from the Surakarta Central Bureau of Statistics the Population Density of Solo City reaches 12,000 inhabitants per one square kilometer. That is certainly a big influence on natural resource needs that are increasing every day and certainly affects the magnitude of the increasing demand for clean water resources and the reduction of rainwater catchment areas which can lead to disasters such as floods and landslides. Besides that global warming is one of the biggest impacts of the destruction of this earth. So that awareness of environmental hazards and scarcity is needed.

Only wise plans will allow humans to enjoy progress. This is confirmed in the Al-Araf,

وَلَا تُفْسِدُوا۟ فِى ٱلْأَرْضِ بَعْدَ إِصْلَٰحِهَا وَٱدْعُوهُ خَوْفًا وَطَمَعًا ۚ إِنَّ رَحْمَتَ ٱللَّهِ قَرِيبٌ مِّنَ ٱلْمُحْسِنِينَ ﴿٥٦﴾

“And do not cause damage on the earth, after (Allah) repairs it and pray to Him with fear (will not be accepted) and hope (will be granted). Surely the mercy of Allah is very near to those who do good.” (Al-A’raf/7:56).

The green roof is the roof of a building partially or completely covered with vegetation and growing media, planted on a waterproof membrane. It also includes additional layers such as root barriers and drainage as an irrigation system. In general, the benefits of green roofs are to reduce the level of air pollution, reduce air temperature, conserve water, reduce noise / noise pollution, display the beauty of aspects of the building (aesthetics), and increase the biodiversity of the city. Moreover green roof has many benefits to reduce the negative impact of global warming. Indeed, green roof is a good alternative for people who will build a house or building to contribute to reducing the effects of global warming.

Not only green roofs, one human effort in reducing global warming or the use of electricity from fossil fuels is the use of solar cells. Solar Cells are devices that consist of solar cells that convert light into electricity. They are called solar over the Sun because the Sun is the strongest light source that can be utilized. Solar Cells are often called photovoltatic cells, photovoltaic can be interpreted as "light-electricity". Solar cells on photovoltaic effects to absorb solar energy and cause currents to flow between two opposite charged layers. The installation of solar cells is effective because the territory of Indonesia is in the tropics.

With the combination of green roofs and the use of solar cells, it will certainly produce a sustainable roof. Of course, a simple design is needed to be

easily applied by the community on every roof of the house. So in this study will focus on the proper design, easy, and simple for people's survival in the future.

B. Problem Statement

Appointed from the background of problems environmental damage in the form of floods and landslides caused by the reduction of land for water absorption is a serious problem. In addition, awareness is needed to maintain the quality of ground water.

Then we need a sustainable roof design that can be applied in a variety of conventional homes. The roof is a combination of green roof, rainwater harvesting, and electricity that uses the sun as its energy source.

The city of Solo will get denser every year. This design is needed to create an environmentally friendly city.

C. Research Purpuoses

Based on background of problem and problem statement, the purposes of this study are as follows:

1. Produce the simple design of green roof.
2. Produce the suitable design of rainwater harvesting after apply the green roof.
3. The design of rainwater harvestings after apply the green roof.
4. Produce the easy and simple plan of using of solar cells.

D. Problem Limitation

In order for the writing in this study to be more directed and systematic, it is necessary to have limitations on object problems and the scope of this research as follows:

1. The design of green roof, the design of rainwater storage, and the plan of sollar cells that is discussed in this research is in city of Surakarta with type of house is 70/120 with 4 peoples inside
2. The rain data of Surakarta from 2004 untul 2018
3. The absorption that occurs on the green roof is not examined
4. The fulfillment of the need for clean water using rwh is only 50% in the wet month, the rest uses the PDAM water source (Perusahaan Daerah Air Minum)

E. Benefit Research

The benefits of this research are as follows:

1. This research can be used as reference by related parties for the design of green roof, the design of rainwater storage, and the plan of sollar cells for type of house is 70/120

F. Authenticity of Research

This research with title "Small Scale Integrated Sustainable Roof Design" has not been done by previous research.

Similar research that has been done is:

1. Rufai Muhammed Ahmed, et al. (2016) in An Evaluation of Green roofing in Building.
2. Uria Karlena Sely (2012) in Utilization Of Green Roof As Rain Water Filter Media In Pontianak City.
3. Jorg Beunig, et al (2013) in Vegetated Roofs (Green Roofs) Combined with Photovoltaic Cells Solar Garden Roof / Sun-Root System.
4. Sara Wilkinson, et al (2105) in Retrofitting Housing with Lightweight Green Roof Technology in Sydney, Australia, and Rio de Janeiro, Brazil
5. Theresia Pynkyawati, et al (2015) Environmentally Friendly Building Roof Models Viewed from Rainwater Treatment at PT Dahana Campus Design, Subang-West Java

G. Similarities and Differences with Previous Research

1. The Similarities and Differences between This Research and The Research Conducted by Rufai Muhammed Ahmed

   This study has similarities with the research conducted by Rufai Muhammed Ahmed is equally as researching the function and effects of green roofs on buildings. This study also explained the differences in the types of green roofs in buildings as well as research conducted by Rufai.

   While the second difference in research is that Rufai Muhammed Ahmed's research method found results by examining green roofs that already exist in several buildings, while in this study it actually made a sustainable green roof design.

2. The Similarities and Differences between This Research and The Research Conducted by Uria Karlena Sely

   This study has similarities with the research conducted by Uriah they both examined the effects of green roofs against rain water that would fall to the ground. Rainwater difference when using green roofs and do not use the green roof.

   The difference between the two studies lies in one of the objectives and the final results of the study. Where one of the goals and final results of the research conducted by Uria is the pH of the water later. As well as in Uria's research did not explain the green roof design that was easily applied to the house